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SOLAR IRRADIANCE STUDIES ON THE SOLAR MAXIMUM MISSION

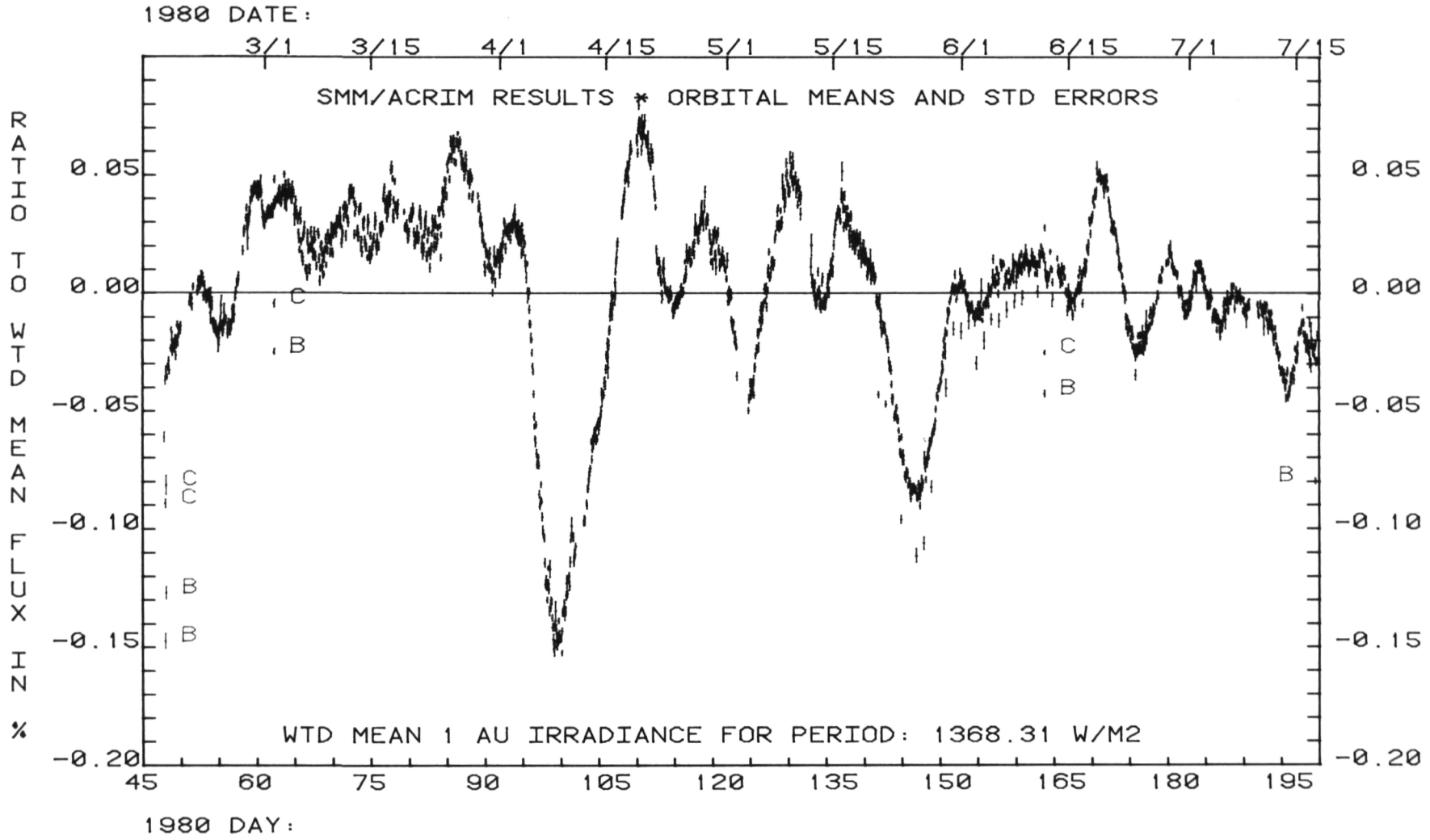
The Active Cavity Radiometer Irradiance Monitor (ACRIM) experiment was launched on the NASA Solar Maximum Mission spacecraft in February 1980 to make regular observations of the solar total irradiance. The principal goals of the experiment are: (1) to begin a climatological data base on solar irradiance variability to be extended over at least one solar magnetic cycle (about 22 years) with ±0.1 percent long-term precision, and (2) to provide a shorter-term data base (minutes to months) with maximum precision for studying aspects of solar variability significant to solar physics investigations.

The first high-precision spacecraft measurements of solar irradiance by ACRIM show that this varied throughout the first 153 days of operation. Fluctuations about the mean 1-astronomical unit irradiance of 1368.31 watts per square meter approached ±0.05 percent.

Two large irradiance events were observed, however, in which the total flux changed by up to 0.2 percent over a 7- to 10-day period. These large decreases in irradiance were linked to specific sunspot groups in early April and late May 1980. The ACRIM detection represents the first direct evidence of large-scale energy storage within the solar convection zone in solar active regions.

Another feature of the ACRIM record was the seeming continuous variability at smaller amplitudes. Thus far, frequencies corresponding to cycles of less than 7 days appear to be absent. This appears to be consistent with sunspot activity, which usually takes more than 7 days to evolve fully.

Figure (opposite page): The 1 AU total solar irradiance for the ACRIM channel A sensor is shown as a percentage variation about the weighted mean for the first 153 days of the Solar Maximum Mission. The individual tick marks represent the mean irradiance for the sunlit portion of one orbit. The vertical bars through each tick mark are the ($\pm 1\sigma$) standard errors of the orbital means. The tick marks with associated "B" and "C" designations are the channel B and C measurements during comparisons with channel A.


1980 DATE:
3/1
3/15
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
SMM/ACRIM RESULTS * ORBITAL MEANS AND STD ERRORS
RATIO TO WTD MEAN FLUX IN %
0.05
0.00
-0.05
-0.10
-0.15
-0.20
WTD MEAN 1 AU IRRADIANCE FOR PERIOD: 1368.31 W/M2
45
60
75
90
105
120
135
150
165
180
195
1980 DAY: